C. Martin; two Hybrid Widgeons (between *Mareca penelope* and *Anas boschas*), bred in England, presented by Mr. Wellesley Taylor; a Cape Viper (*Causus rhombeatus*), two Rufescent Snakes (*Leptodira rufescens*) from South Africa, presented by Mr. J. E. Matcham; a Great Kangaroo (*Macropus giganteus*) from Australia, deposited; two Hunter's Spiny Mice (*Acomys hunteri*), born in the Gardens.

OUR ASTRONOMICAL COLUMN.

RUTHERFURD'S STELLAR PHOTOGRAPHS. — The pioneer work of the late Dr. Rutherfurd in photographic star charting is gradually assuming a form which gives the results a high scientific value. In 1890, Dr. Rutherfurd presented his original negatives, many of them taken more than twenty years ago, to the Columbia College Observatory, New York, together with some thirty volumes of measures of certain star photographs, and Prof. J. K. Rees was authorised to arrange for the discussion of the photographs. After Dr. Rutherfurd's death in 1892, his son, Rutherfurd Stuyvesant, generously provided funds for continuing the reduction and publication of the measures. The results obtained for the stars of the Pleiades group, and for the stars about β Cygni have already been published, as well as an investigation of the parallaxes of μ and θ Cassiopeiæ. To these are now added two papers giving full details of an investigation of the parallax of η Cassiopeiæ, and of the reduction of positions of sixty-two stars in the neighbourhood (*Ann. New York Acad. Sci.*, vol. viii. 301, 381). Using three pairs of comparison stars, the parallax deduced for η Cassiopeiæ is 0″·443 ± 0″·043; or, taking six pairs, 0″·465 ± 0″·044 (see NATURE, vol. lii. p. 61). In view of the difficulty of getting comparison stars suitably situated either with respect to position angle, or distance, it was considered desirable to take a larger number than usual, and hence six pairs were reduced, being all that were sufficiently impressed on the plates in both seasons of the year. Only the three pairs which lead to the first-named value, however, are so situated with reference to the parallactic ellipse as to give good coefficients for the parallax.

RADIAL VELOCITIES OF SATURN.—The recent spectroscopic investigations of the velocities in the Saturnian system furnish an admirable illustration of the accuracy at present attainable in this department of astronomical research. Prof. Keeler, M. Deslandres, Prof. Campbell, and Dr. Belopolsky have each in turn directed their attention to the planet, and the following table brings together the different results obtained, and compares them with the computed velocities:—

		Equatorial velocity of planet.		Excess of velocity for inner edge of ring.
Keeler	...	10·3 km. per sec.	...	3·6 km. per sec.
Deslandres	...	9·4 ,,	...	4·7 ,,
Campbell	...	9·77 ,,	...	3·13 ,,
Belopolsky	...	9·4 ,,	...	5·5 ,,
Computed	...	10·3 ,,	...	3·9 ,,

It thus appears that in the hands of competent observers, the photographic methods now employed for the determination of velocities along the line of sight may be relied upon to give values which are correct to within one kilometre per second; while for results depending upon the measurement of more than one velocity, a little greater latitude must be allowed.

In reply to the objection of M. Deslandres and Prof. Seeliger, that the spectroscopic results do not strictly prove the meteoritic constitution of the ring, Prof. Keeler has pointed out that any other explanation which is consistent with them can only be regarded as artificial, or inherently improbable (*Ast. Nach.* 3313). If the ring were composed of concentric solid rings, a line in the spectrum would be made up of short straight lines, like an end view of a flight of stairs. Prof. Keeler does not consider his own photographs capable of showing more than ten such subdivisions, for if the number were greater than this, the step-like structure of the lines would be destroyed by unavoidable errors in guiding; but up to a certain point the effect would still be apparent in the widening of the lines. He finds, however, that the definition of the lines in the spectrum of the ring is less affected by guiding errors than that of the lines of the planet, as might be expected if the lines were smooth curves such as would be produced in the case of a meteoritic ring.

THE CAPE OBSERVATORY.—Dr. Gill's report of the work done at the Cape Observatory during 1894 has been distributed. It opens by pointing out that the chief desideratum in astronomy during the past decade has been an adequate provision for the study of astrophysics in the southern hemisphere. As the readers of NATURE are aware, Mr. Frank McClean, F.R.S., has given to the Cape Observatory a splendid equipment for such work, so the need has been met, and a harvest of results may be looked for as soon as the instrument is erected. With reference to this generous gift, the report says that the telescope will have a photographic object-glass of 24 inches aperture and 22½ feet focal length, and be provided with an objective prism of the same aperture having a refracting angle of 7½°. Mounted parallel to this there will be a visual telescope of 18 inches aperture and of the same focal length as the photographic telescope. The equatorial mounting will have complete circumpolar motion for within 30° of the zenith; and will be sufficiently elevated to allow of a slit spectroscope suitable for determining motion in the line of sight. Such a spectroscope will also be provided by Mr. McClean, together with an observatory of light construction. The instrument has been for some time under construction by Sir Howard Grubb, and will probably be completed before the end of 1896.

Among the work done with the astro-photographic telescope, we notice that, after rejecting all plates of insufficient exposure, or which are otherwise faulty, only 70 of the plates for the Catalogue, out of 1632 areas assigned to the Cape, remain to be done. Of the chart plates, 263 have been passed as satisfactory.

Measures of the diameters of the photographic discs of a variable star in Vela, together with those of nine comparison stars, prove the former to be a variable of the Algol type, its period being about 5d. 22h. 24m. 4s. A complete discussion of the light curve and period will shortly be undertaken.

The researches on the solar parallax have been carried forward, three sections of the work, on the observations of the minor planets Victoria and Sappho, having been passed through the press. The manuscript of the definitive discussion of the observations of Victoria has been sent to the printers; while the computations of the solar parallax from the observations of Sappho and Dr. Elkin's reductions of the observations of Iris are completed.

THE INSTITUTION OF MECHANICAL ENGINEERS.

AN ordinary general meeting of the Institution of Mechanical Engineers was held on the evenings of Wednesday and Thursday, October 23 and 24, at the Royal United Service Institution, Whitehall, the Council having lent their new theatre for the purpose. The building of the Institution of Civil Engineers, where the Mechanical Engineers have held their London meetings for years, is now in process of rebuilding. It is to be hoped, however, that the Institution of Mechanical Engineers will, before long, have their own premises.

There were three papers down for reading on the first day of the meeting:—

"The Electric Lighting of Edinburgh," by Henry J. Burstall.

"Report on the Lille Experiments upon the Efficiency of Ropes and Belts for the Transmission of Power," translated by Prof. David S. Capper.

"Observations on the Lille Experiments upon the Efficiency of Ropes and Belts for the Transmission of Power," by Prof. David S. Capper.

The chair was taken on each evening at 7.30, by Prof. Alexander B. W. Kennedy, F.R.S. On the first evening Mr. Burstall's paper was read and discussed.

The electric lighting of Edinburgh is in the hands of the Corporation. It was decided upon in 1893, when the work of designing and superintending the scheme was entrusted to Prof. Kennedy, the President of the Institution. From an electrical point of view the city consists of two districts. In one the houses are close together, and the demand for light may be expected to be fairly concentrated; in the other it will be more scattered. Having regard to the different districts to be served, and taking into account all the local circumstances, it was decided, after comparison of the various systems of supply and distribution which could be used, to adopt a low tension three-wire system for the central and northern district, and an alternating-current high tension system for the southern and eastern district, both systems being worked from one central station, and under the same control and management. A good site was found for the central station between the Caledonian Railway and Dewar Place.

The boiler-house is designed to contain seventeen boilers, of which at present only six are in place. They are of the dry-backed marine type, each $10\frac{1}{4}$ feet mean diameter and 12 feet long, with two Purves flues $3\frac{1}{4}$ feet inside diameter, and 166 tubes of 3 inches internal diameter. The boilers are of steel with wrought-iron tubes. On the top of the boilers are fitted super-heaters, each having two nests of tubes enclosed between the top of the boiler shell and a fire-brick casing above. Each consists of thirty-two vertical flat coils of wrought-iron tube $1\frac{1}{2}$ inches diameter. Sinclair's mechanical stokers are fitted to each boiler, and are driven by an electric motor. The main steam pipe forms a complete ring round the present boilers. This ring joins the engine-room main at two points, and is provided with valves, so that the failure of any one pipe will put only the corresponding boiler out of use. The pump-room contains at present one duplex steam pump and two three-throw pumps driven electrically, each pump specially designed to run with a large range of speed, and for this purpose can be connected with either the 230-volt or the 115-volt mains. A Kennedy water meter is connected with one range of feed pipes, so that the whole of the water going to the boilers can be measured. In the pump-room is placed the electric motor for driving the mechanical stokers with its counter shaft. The coal brought in the railway trucks is at present stored in the east end of the boiler-house; on the station being extended, the coal will be stored over the boiler-house, and let down through shoots to the mechanical stokers. In designing the plant at present in the boiler-house, provision for extensions has been kept in mind, and the arrangements are such that new plant can be added at any time.

The engine-rooms are side by side, forming really one room divided by a line of columns which carry the roofs and the beams for the travelling cranes. The engine-room next the boiler-house is reserved for the low-tension plant, the other contains the high-tension plant. A platform, raised 4 feet above the engine-room floor level, runs the whole way across the west end of both engine-rooms; and on this are placed the switchboards and regulating gear for both the low- and high-tension systems. The machinery at present in the low-tension engine-room consists of eight engines, four of 100 I.H.P., two of 250 I.H.P., and two of 360 I.H.P., with their dynamos; and provision is made for eight more engines of 360 I.H.P., in the future. All are Willans central-valve engines driving their dynamos direct. All the dynamos are two-pole shunt-wound machines with drum armatures, all wound to give 270 volts, except two which are driven by two 100 I.H.P. engines; these two are wound to give 135 volts, being used as balancing machines on the three-wire system. The steam-piping forms, with part of the boiler-house ring, a complete ring round the low-tension engine-room, and is connected with the boiler-house ring at two points. The main ring is 8 inches internal diameter throughout. The straight lengths are of steel, with thick flanges screwed and brazed on; the tee pieces and valve boxes are of cast-iron; and the bends of copper with steel flanges. All bends are of large radius, and no expansion joints are used or required. The engines are erected in pairs, and are connected with the main ring by two long copper bends. The pipes are slung by long rods from brackets fixed on the walls or columns, so as to allow free movement. The main exhaust pipes are of cast-iron, and are led through a Berryman feed-heater, in the boiler-house to the chimney. Provision is made for three more heaters when required. The whole of the machinery stands on a concrete foundation block $7\frac{1}{2}$ feet thick, which is separate from the foundations of the walls.

The main leads from the dynamos are drawn through curved wrought-iron pipes let into the concrete, into chases in the centre of the engine foundation block, along which they are carried to the chamber under the switchboard platform. The leads from the field winding off the machines are also carried in the same manner to their regulating resistances; the switches for these resistances are fixed upon the handrail on the platform in front of the switchboard, the leads from the resistances being brought up through the posts of the handrail. The switchboard, and the whole of the apparatus for regulating the dynamos and the batteries, and for the distribution of the current, are placed on the platform, and are directly under the eye of the engineer in charge. The switchboard consists of seven slate panels, each about 7 feet high, and stands 4 feet from the west wall of the engine-room. The arrangement of the switchboard and conductors was next described.

The battery-room has a fire-proof floor covered with acid resisting asphalt. The battery consists of 132 cells of the new Crompton-Howell 31-plate type. It is divided up into two half-batteries, positive and negative, and is arranged in two tiers on four rows of stands, which are of cast-iron, with wooden longitudinal bearers carrying the cells; the eight hospital cells are arranged on separate stands. All the cells are similar, and have each a nominal capacity of 1000 ampere hours, the normal rate of discharge being 200 amperes. The battery has ample capacity to meet the whole of the load of the station from daylight till the evening; thus during the summer time it can do the lighting during more than half the twenty-four hours. The high-tension portion of the station consists at present of only two engines and alternators with their switchboard, and the rectifiers for arc-lighting with their regulating arrangements and switchboard; but in the immediate future, this plant will be considerably extended. Each of the alternators is driven direct by a Willan's three-crank engine of 150 I.H P., on the same bed-plate. The alternators are of the "Portsmouth" type, with some modifications necessary owing to their increased speed of 450 revolutions per minute. Their armatures are stationary, and are of great strength; the core, consisting of sheet-iron segments, is solidly bolted into the framing of the machine, with the coils threaded through holes in the sheet-iron, well insulated, and completely enclosed in brass boxes. The field magnets revolve, and consist of two heavy cast-steel discs, having on their circumference claws projecting sideways alternately over the field winding, which is between the discs, and is well protected from injury. The exciting current is taken from the low-tension switchboard at 230 volts, and is only a few amperes. The alternators work at an electromotive force of between 2000 and 2200 volts with a frequency of $52\frac{1}{2}$ figures complete alternations per second. Opposite to the alternators, and standing on the same foundation block, are placed the Ferranti rectifiers for the series arc-lighting. These are three in number, one for each of the two circuits, and one to spare.

In the three-wire system of distribution for the northern and central districts, the electromotive force between the two outer conductors, positive and negative, is 230 volts, while that between the middle wire and the positive or negative is 115 volts. The latter is the electromotive force of the lamps on the consumers' premises, no trouble being now experienced in obtaining glow-lamps to work at this electromotive force, or even higher. The feeders from the station are connected to the distributing mains at sixteen points They consist of two conductors only, the positive and negative; the middle wire is inter-connected throughout as much as possible, and is brought back from three districts on the system. The cables are put in parallel at the station, and one connection only is made to the switchboard. The positive and negative sides respectively of all the feeders are put in parallel at the switchboard; but any feeder or feeders can be put on a separate machine if required. As far as possible, consumers in each street and district are balanced against one another by connecting them alternately between positive and middle wires, and between negative and middle wires; large consumers have all three wires taken into their premises, and their lights balanced against one another in a similar manner. But however carefully this balancing is done, it is impossible to get a really accurate balance; the "out of balance" current varies from hour to hour, and even from minute to minute, and is different on different days of the week. The amount out of balance is compensated for at the station by means of the balancing machines, one of which can be put on either side of the system; the balancing during the light load is done from the battery alone. Light wires, forming potential leads or pilot wires, are brought back from all three conductors at each feeding point, and are connected to the feeder volt meters on the switchboard; so that the pressure at the feeding points at any part of the system is directly known at the station, and the necessary regulation made for keeping the electromotive force constant. The distributing mains are brought back to the station, but are used only for the supply of light and power there; no regulation is done on the mains anywhere, except to the feeding points. No high-tension feeders or distributing mains have yet been laid, but will be added later.

In regard to road-work, practically the whole of the distributing mains are laid as cable insulated with india-rubber heavily braided, drawn into Doulton stoneware casing under the footways, and into either Crompton-Davis cast-iron casing or cast-iron pipes under the roadways. At all crossings, and at intermediate places on the foot-ways, brick junction boxes are built. Wherever sufficient space has been found under the footways, the feeders have been laid as bare copper strip, carried on stoneware insulators in concrete culverts. Across all roads, and where there has not been sufficient space for culvert, the feeders are laid in Siemens armoured cable, laid direct in the ground. All the feeders have been designed to have a total drop of 44 volts at full load Potential leads, by which each feeding point is connected back to the station, consist each of three sets of wires, insulated with specially prepared paper, laid up together and covered with the same material, a lead tube being drawn over the whole. All of the cable connections are made by cone connectors, sweated on to the cables, and fitting into gun-metal connecting blocks.

The author concluded by stating that he had endeavoured to describe the arrangement of the plant and mains, and any details in their design and construction which might be of interest, without discussing general principles or the advantages or disadvantages of any individual system.

In the discussion which followed the reading of the paper, the chief point raised was the advisability of using a dual system of supply; but the author very well disposed of the objections raised in this direction by pointing out that the area to be dealt with consisted of two districts differing widely in character. For one the high pressure alternating system was most desirable, and for the other a low tension system. It is easy, as Mr. Burstall said, to maintain that either system is wrong if the disadvantages of that system are given undue prominence, and the advantages of the rival system are brought prominently forward. Of course, the benefit of the high-tension alternating system consisted in the saving of copper, but that was a thing that perhaps would not work out in practice exactly in the same way as it was presented in theory. On paper, a larger main was required for low-tension transmission, but practically there was often no saving in copper. As a matter of fact there is, however, an economy in material in the feeders. It becomes a question of balance of advantages, whether certain points shall be sacrificed to the saving of copper. Mr. Burstall stated that so far as Edinburgh was concerned, no less than six schemes were worked out in detail before it was decided to adopt the plans described in the paper. The discussion also ranged over the question of superheating steam, the efficiency of feed pumps, and various other engineering details, which, however, it is not necessary here to consider in connection with an electrical paper, especially as no new facts of importance were added to one's information upon these matters.

The second paper, on the Lille experiments with ropes and belts, does not need any extended notice at our hands. The Société Industrielle du Nord de la France had the question of transmission of power brought before them by a paper by M. V. Dubreuil, and it being considered advisable to obtain more information on this subject, a commission was appointed, and the Institution of Mechanical Engineers was invited to send a representative. Various trials were made with ropes and belts under different conditions. Owing to the want chiefly of dynamometer records, no very exact figures could be deduced from the experiments, so far as the actual power transmitted was concerned. An effort was made to make the experiments comparative as between ropes and belts, by keeping the experimental conditions in both cases constant. It is somewhat doubtful, however, to what extent these efforts were attended by success. Generally speaking, it may be said that the results arrived at showed the power absorbed by transmission to be equal, whether ropes or belts were used. This conclusion, however, must be accepted with some reserve.

Prof. Capper in his paper, commenting on the experiments, attempted to arrive at some conclusion as to the efficiency of the whole system. His figures were excellently worked out, but he himself acknowledged that the data upon which he based his calculations might be open to question. Although, therefore, the experiments may not be of great use to future designers of machinery, the thanks of English engineers are none the less due to the Société Industrielle for their courtesy in inviting the Institution of Mechanical Engineers to send a representative to watch the proceedings. The Institution is also to be congratulated in being able to send so competent an observer as Prof. Capper as their representative.

A long discussion followed the reading of the paper, which occupied the rest of the evening. Perhaps the most interesting part of it were the remarks of Mr. Crompton, who stated that the question of transmission by ropes and belts did not possess any longer the importance it once did, as within a few years the silent, flexible connecting rod, called electricity, would supersede all other methods of transmission, so that ropes and belts would only be found exhibited in museums, as mechanical curiosities of a past era.

RECENT FISHERY LITERATURE.

THE general report for 1894 of the Fishery Board for Scotland contains evidences of the revolution which is quietly but steadily effecting a complete change in the methods of the fishing industry. There is a further falling-off in the number of fishermen and fishing boats engaged in the herring and line fishing. The sailing craft continue to give way before steam trawlers and steam liners, and the competition for the best markets is bringing about an increased centralisation of the fishing industry. The smaller and healthier creeks and villages are being gradually depopulated, and the larger ports are becoming overcrowded. The summer herring fishing is being forsaken for line fishing, which can be prosecuted all the year round. Steam liners are consequently increasing rapidly in number, and during the past year have proved most successful. Indeed, in spite of the falling off in the means of capture, the decrease in the total quantity of fish landed, as compared with the returns for 1893, amounted to only 19,000 cwts. This state of things may be attributed to the fact that the steam trawlers and liners are able to proceed much further out to sea than sailing craft, and are able to fish over fresh grounds where large catches are frequently obtained. Being larger and stronger, moreover, these vessels are to a great extent independent of wind and weather, which seriously affect the movements of the smaller sailing boats. Herring were locally plentiful, and of a quality never excelled within modern times. They were especially abundant in the Orkneys and Shetlands—where the catch was double that of 1893—and in the Campbelltown area; but the herring fishery in the Hebrides was again a failure, and this is the more to be regretted as Stornoway, the most important centre for ling, also exhibited a large falling off in the returns of the latter fish. It is gratifying to notice a slight increase in the returns of flat fish, especially in view of the complaints of the depletion of grounds frequented by them. The increase may, however, be due to the hauls made by steam trawlers working on fresh and more distant grounds. For the first time in the Board's returns, a table is given of the number of persons engaged in Scotch fisheries on sea and land; there are more than 117,000 people taking some part in the various branches of the industry.

The report of the same Board on Salmon Fisheries shows that the season of 1894 was in most districts below the average. On the other hand, salmon disease appears on the whole to have been less prevalent during 1894 than in the previous year.

In an interesting and amusing article on the North Sea fisheries ("Journal of the Marine Biological Association," vol. iii., 1895), Mr. Holt devotes especial attention to the question of the destruction of immature fish. The fact that there has been a diminution of the fish supply during recent years seems to be thoroughly established, although the improved boats and methods of fishing render this decrease less striking than might otherwise be the case. The alleged cause of this diminution is over-fishing, that is to say over-trawling, but inshore trawlers, shrimpers, and other fishermen do not appear to be blameless in the matter. During some years' residence at Grimsby, Mr. Holt has collected statistics on this question. They are necessarily incomplete, as time and opportunity did not permit of wide investigation; they are, however, fairly complete in the case of the plaice, one of the most important of our flat fishes, and Mr. Holt's evidence concerning this fish is very striking. He states that during a whole year's trawling on the North Sea grounds 57 per cent. of the plaice brought to shore were sexually immature, and had thus never had a chance of reproducing their species, and so contributing to the maintenance of the supply. In the Conference of 1892 the size limit for plaice was made 10 inches; they are marketable at this size, although not sexually mature, for Mr. Holt finds that as a rule North Sea plaice are not mature until they attain a length of 17